

## Evaluating the ADM2895E/ADM2895E-1, 5.7kV<sub>RMS</sub> Signal and Power Isolated Half-Duplex RS-485 Transceiver with Fault Protection

### FEATURES

- ▶ Simplified evaluation of the ADM2895E/ADM2895E-1 250kbps half-duplex isolated RS-485 transceiver
- ▶ 2-layer PCB compliant to EN 55032 Class B radiated emissions
- ▶ Footprint for 10mm × 10mm, 28-lead SOIC\_FPC package with >8.0mm creepage and clearance
- ▶ On-board ADP7104 LDO regulators with jumper options for simplified evaluation in multiple supply configurations
- ▶ Flexible, low voltage V<sub>IO</sub> supply rail for interfacing with I/O nodes as low as 1.7V
- ▶ Selectable 3.3V or 5V isolated V<sub>ISOOUT</sub> supply
- ▶ IEC 61000-4-2 ESD protection on Pin A and Pin B
  - ▶ ±4kV contact discharge
- ▶ SMA connector for TxD input signal
- ▶ Optional on-board LTC6900 oscillator for providing TxD signal
- ▶ Screw terminal blocks for connecting power, digital, and RS-485 signals
- ▶ Jumper-selectable enable and disable for digital input signals
- ▶ Resistors and footprints for termination
- ▶ Test points for measuring all signals

### EVALUATION BOARD CONTENTS

- ▶ EVAL-ADM2895EEBZ evaluation board

### EQUIPMENT NEEDED

- ▶ Oscilloscope
- ▶ Signal generator (optional)
- ▶ 3V to 5.5V supply
- ▶ 1.7V to 5.5V supply (optional)

### DOCUMENTS NEEDED

- ▶ ADM2895E/ADM2895E-1 data sheets

### GENERAL DESCRIPTION

The EVAL-ADM2895EEBZ allows simplified, efficient evaluation of the ADM2895E/ADM2895E-1, 5.7kV<sub>RMS</sub>, 250kbps (for ADM2895E) half-duplex signal and power isolated RS-485 transceiver. The EVAL-ADM2895EEBZ can also be used to evaluate the higher speed 20Mbps (for ADM2895E-1) by replacing the low-speed part with the higher speed part.

The ADM2895E/ADM2895E-1 features an integrated, isolated, DC-to-DC converter that provides power to the isolated side of the device with no additional ICs required.

The EVAL-ADM2895EEBZ comes with options for the evaluation of the ADM2895E/ADM2895E-1 device in an individual system. Digital and RS-485 bus signals are easily accessible by the screw terminal blocks on the EVAL-ADM2895EEBZ. Each digital input can be configured by the on-board jumper options.

An on-board ADP7104 low dropout (LDO) regulator accepts an input voltage of up to 20V and outputs a range of selectable supply voltages to the V<sub>CC</sub> pin, configurable by jumper options. The LDO regulator can be bypassed to power the ADM2895E/ADM2895E-1 V<sub>CC</sub> supply pin directly from an external power supply.

The flexible V<sub>IO</sub> pin primary side logic supply allows the device to operate with a digital input/output (I/O) voltage from 1.7V to 5.5V, which enables communication with modern microprocessors using either a 1.8V or 2.5V power supply. The V<sub>IO</sub> pin can also be supplied from the ADP7104 regulated supply.

Different methods can be used to provide the transmit data input (TxD) signal to the device. An optional LTC6900 oscillator is included on the EVAL-ADM2895EEBZ and can be configured to provide a clock signal as the TxD digital input within a 10kHz to 20MHz range. Jumper settings allows frequency selections of 10kHz, 100kHz, 1MHz, 10MHz, or TBD based on the value of a customer installed 0603 resistor. Note that frequencies above 125kHz are intended for when the higher speed ADM2895E/ADM2895E-1 part is installed. A terminal block allows an easy wired connection to a microcontroller or processor. For optimal signal integrity, use the on-board Subminiature Version A (SMA) connector to connect an external data signal.

The EVAL-ADM2895EEBZ has a footprint for the ADM2895E/ADM2895E-1 half-duplex, isolated, RS-485 transceiver in a 10mm × 10mm, 28-lead, small outline, fine-pitch (SOIC\_FPC) package.

**Table 1** shows the available devices that can be evaluated using the EVAL-ADM2895EEBZ.

**Table 1. List of Available Devices for Evaluation**

Device	Isolation Rating	Maximum Data Rate
ADM2895E	5.7kV <sub>RMS</sub>	250kbps
ADM2895E-1	5.7kV <sub>RMS</sub>	20Mbps

Full specifications on the ADM2895E/ADM2895E-1 are available in the ADM2895E/ADM2895E-1 data sheet available from Analog Devices, Inc., and must be consulted with this user guide when using the EVAL-ADM2895EEBZ evaluation board.

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**REVISION HISTORY****4/2025—Rev. 0 to Rev. A**

Changes to Features Section..... 1

**1/2025—Revision 0: Initial Version**

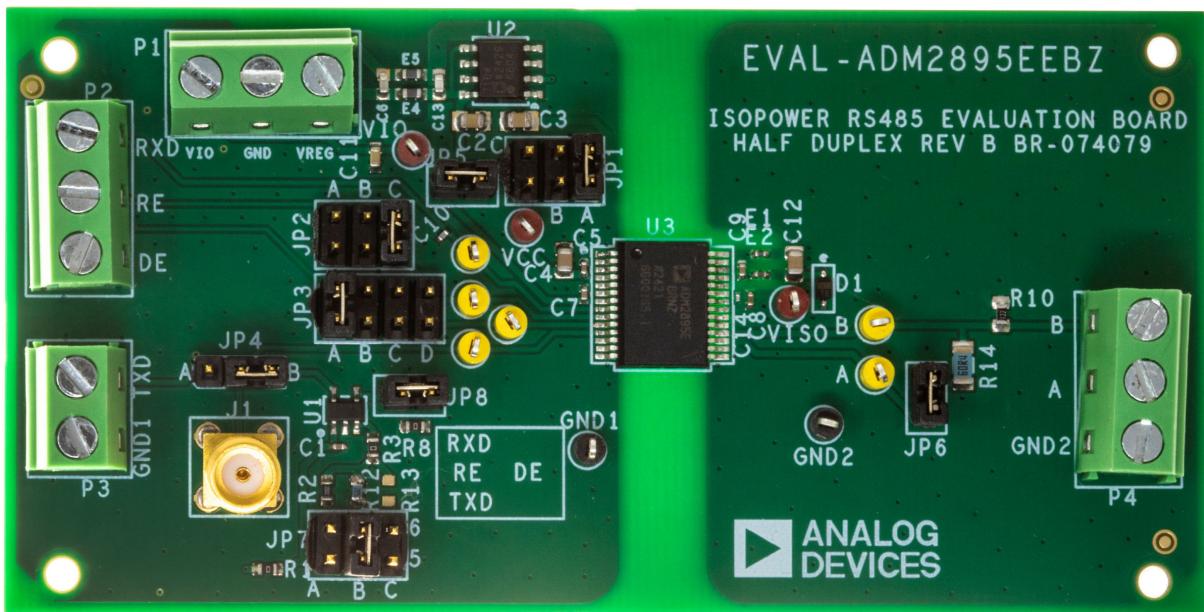
**EVALUATION BOARD PHOTOGRAPH**

Figure 1. EVAL-ADM2895EEBZ Evaluation Board Photograph

## EVALUATION BOARD HARDWARE

### POWERING THE EVALUATION BOARD

The [ADM2895E/ADM2895E-1](#) is an isolated RS-485 transceiver, which requires a power supply only on the logic side of the device. The ADM2895E/ADM2895E-1 features an internal isolated power supply, which provides the power for the isolated side of the device. The ADM2895E/ADM2895E-1 has the option of powering the logic I/O ( $V_{IO}$ ) separately from isolated power supply ( $V_{CC}$ ) to support lower voltage logic interfaces. This is reflected by the EVAL-ADM2895EEBZ's VREG\_IN and VIO inputs, which are located on the P1 screw terminal connectors.

The VREG\_IN input has a common mode EMI filter consisting of C6, E4, E5, and C13. The output of the filter is connected to an [ADP7104](#) low dropout regulator to provide a range of regulated supply voltages to the  $V_{CC}$  pin of the ADM2895E/ADM2895E-1. Different voltages are selected using the JP1 jumper (including a total bypass of the ADP7104). The output of the ADP7104 voltage regulator has a  $1\mu F$  decoupling capacitor (C3). The ADM2895E's  $V_{CC}$  pin is fitted with a  $10\mu F$  decoupling capacitor (C4) and a  $0.1\mu F$  decoupling capacitor (C5).

The logic interface voltage for the ADM2895E/ADM2895E-1 is powered from the output of the ADP7104 when jumper JP5 is present and by P1's  $V_{IO}$  input when JP5 is not present.

The  $V_{SEL}$  pin of the ADM2895E/ADM2895E-1 is used to select the isolated supply voltage for the RS-485 transceiver. To configure the device to output a 3.3V isolated supply voltage, connect the ADM2895E/ADM2895E-1  $V_{SEL}$  pin to the  $GND_{ISO}$  pins by populating a  $0\Omega$  resistor in R7. To configure the device to output a 5V isolated supply voltage, connect the ADM2895E/ADM2895E-1  $V_{SEL}$  pin to the  $V_{ISOOUT}$  pin by populating a  $0\Omega$  resistor in R6. Avoid populating the R6 and R7 resistors at the same time because this creates a short between the power and ground pins. The EVAL-ADM2895EEBZ is configured with R7 installed for a 3.3V isolated supply voltage.

For more details on the jumper and power supply connections, see [Table 2](#) and [Table 3](#). The corresponding labeled test points allow for monitoring of the  $V_{CC}$ ,  $V_{IO}$ , and  $V_{ISO}$  supply voltages.

### SIGNAL INPUT AND OUTPUT CONNECTIONS

Digital input and output signals are connected by the P2 and P3 screw terminal blocks to allow wire connections from the EVAL-ADM2895EEBZ to a signal generator or microcontroller for input and a load for output. The P2 terminal block includes screw terminals for receiver data output (RxD), receiver enable input ( $\overline{RE}$ ), and driver enable input (DE). Alternatively, jumper connection on JP2 and JP3 can connect these input signals together, to the  $V_{IO}$  or  $GND_1$  pins of the ADM2895E/ADM2895E-1 (see [Table 2](#)).

The P3 terminal block has the screw terminals for TxD. Alternatively, jumper JP4 allows connection of this input to an [LTC6900](#) oscillator (for more details on the oscillator configuration, see the [On-Board LTC6900 Oscillator](#) section). SMA connector J1 can be used for either monitoring the TxD input or as an alternate input format to the screw terminals of P3.

Connections to the RS-485 bus are made by the JP8 screw terminal block. The EVAL-ADM2895EEBZ has two bus signals: Pin A for the noninverting input/output signal and Pin B for the inverting input/output signal. The bus cables also include a common ground connection and can be connected to the JP8 screw terminal block. Test points are available on the EVAL-ADM2895EEBZ and are appropriately labeled for all digital and bus signals.

### RADIATED EMISSIONS

The ADM2895E/ADM2895E-1 encodes data across the isolation barrier using an ON-OFF keying (OOK) modulation scheme using nominal carrier frequencies of 3.8GHz and 4.2GHz. The OOK modulation is optimized for both high noise immunity and minimal radiated emissions. The isolated power supply operates with a variable switching frequency in the range of 180MHz to 400MHz.

The EVAL-ADM2895EEBZ is a 2-layer printed circuit board (PCB) that meets the EN 55032 Class B radiated emissions requirements under full load while operating at data rates above 6kbps up to the maximum data rate of 250kbps for the ADM2895E (or 20Mbps when the ADM2895E-1 is present). To maximize the margin to the EN 55032 Class B specification in other designs, check the following guidelines, which have been followed in the design of the EVAL-ADM2895EEBZ:

- ▶ Place common mode ferrites (E1 and E2) in between  $V_{ISO\_OUT}$  /  $GND_{ISO}$  and  $V_{ISO\_IN}$  /  $GND_{ISO}$ . These ferrites must have an impedance of at least  $2k\Omega$  between 100MHz and 2GHz. The effectiveness of the ferrites is maximized by reducing the parasitic shorting capacitor formed by copper planes located under the ferrites. Therefore, keep all PCB layers directly below and immediately adjacent to the ferrites free of all copper.
- ▶ Place a  $0.1\mu F$  capacitor (C9) between the  $V_{ISOOUT}$  and  $GND_{ISO}$  pins.
- ▶ Minimize the trace length/area between the  $V_{ISO\_OUT}$  /  $GND_{ISO}$  pins and the common mode filter (E1 and E2).
- ▶ Place a  $10\mu F$  capacitor (C12) on the output of the ferrite filter.
- ▶ Place a  $0.1\mu F$  capacitor (C4) between the  $V_{CC}$  and  $GND_1$  pins.
- ▶ Place decoupling capacitors with  $2.2pF$  (C12) and  $0.1\mu F$  (C5) between the  $V_{ISOIN}$  and  $GND_2$  pins.
- ▶ Capacitor C12 must be selected to have a self-resonant frequency above 4.3GHz.
- ▶ Ensure that the decoupling capacitors are placed as close as possible to the corresponding ADM2895E/ADM2895E-1 pins.

## EVALUATION BOARD HARDWARE

### JUMPER CONFIGURATIONS

Table 2. Jumper Configurations

Link	Jumper Connection <sup>1</sup>	Description
JP1	<b>A*</b>	Configures the <a href="#">ADP7104</a> voltage regulator, U2, to supply a regulated voltage to the <a href="#">ADM2895E/ADM2895E-1</a> $V_{CC}$ pin. 5V.
	B	3.3V.
	C	Bypasses the ADP7104 voltage regulator, U2, and powers the ADM2895E/ADM2895E-1 $V_{DD_1}$ supply pin from the VREG_IN terminal on the P1 connector.
JP2		$\overline{RE}$ input connection configuration. $V_{IO}$ pin. This setting disables the receiver.
	A	$\overline{RE}$ terminal on the P2 connector.
	B	$GND_1$ pin. This setting enables the receiver.
	<b>C*</b>	
JP3		DE input connection configuration. $V_{IO}$ pin. This setting enables the driver.
	<b>A*</b>	DE terminal on the P2 connector.
	B	$GND_1$ pin. This setting disables the driver.
	C	$\overline{RE}$ input signal. This means that the input for both $\overline{RE}$ and DE is set by the JP2 jumper. This setting ensures that when the driver is enabled, the receiver is disabled, or when the driver is disabled, the receiver is enabled.
	D	
JP4	A	TxD pin input source selection. P3 Pin 1.
	<b>B*</b>	<a href="#">LTC6900</a> oscillator output.
JP5	<b>Inserted*</b> Not Inserted	Configures the connection between the ADM2895E/ADM2895E-1's $V_{CC}$ and $V_{IO}$ pins. $V_{CC}$ and $V_{IO}$ are connected and $V_{IO}$ is supplied from the same source as $V_{CC}$ . $V_{CC}$ and $V_{IO}$ are disconnected and $V_{IO}$ must be supplied by P1.
JP6	<b>Inserted*</b> Not Inserted	RS-485 Bus termination resistor configuration. Connects R14, the 60.4 $\Omega$ termination resistor, across the ADM2895E/ADM2895E-1 Pin A and Pin B. Disconnects R14, the 60.4 $\Omega$ termination resistor, across the ADM2895E/ADM2895E-1 Pin A and Pin B.
JP7	A <b>B*</b> C	Sets LTC6900 oscillator frequency to: 10MHz (JP8 inserted) or 1MHz (JP8 not inserted). 100kHz (JP8 inserted) or 10kHz (JP8 not inserted). TBDHz based on value of customer installed resistor R13.
JP8	<b>Inserted*</b> Not Inserted	LTC6900 oscillator frequency range configuration: High frequency range operation, N=1. Low frequency range operation, N=10.

<sup>1</sup> \* shows the default setting.

## EVALUATION BOARD HARDWARE

### BUS TERMINATION AND BUS IDLE FAIL-SAFE BIAS RESISTORS

The EVAL-ADM2895EEBZ has a 1206 sized package footprint for a termination resistor (R14). A 60.4Ω termination resistor is fitted to R14 on the EVAL-ADM2895EEBZ, but this resistor can be removed or replaced with a resistor of a different value as needed. Insert the JP6 jumper to connect the R14 resistor and add the 60.4Ω load to the RS-485 driver/receiver.

The [ADM2895E/ADM2895E-1](#) has a built in receiver fail-safe for the bus idle condition, which typically does not require an external fail-safe biasing network. However, the EVAL-ADM2895EEBZ includes provisions for this network by R9 and R10. R9 is a pull-up resistor from the ADM2895E/ADM2895E-1 Pin A to the  $V_{ISO}$  supply and R10 is a pull-down resistor from Pin B to the  $GND_2$ . These resistors can be fitted if the user is connecting to other devices, which require external biasing resistors on the bus. The resistor value depends on the minimum bus idle voltage for the other device(s), the minimum supply voltage, and the termination scheme.

The EVAL-ADM2895EEBZ comes with 1.2kΩ resistors installed in a 0805 sized package.

For more details on the bus idle fail-safe, refer to the [Application Note AN-960: RS-485/RS-422 Circuit Implementation Guide](#).

### ON-BOARD LTC6900 OSCILLATOR

An [LTC6900](#) clock oscillator is provided on the EVAL-ADM2895EEBZ to allow the convenient evaluation of the ADM2895E/ADM2895E-1 without the need for an external signal source. The oscillator frequency may be selected by a jumper setting and/or a customer supplied resistor.

The LTC6900 oscillator is powered from the  $V_{IO}$  supply, and can only be used when the  $V_{IO}$  supply voltage is between 2.7V and 5.5V. By removing the 0Ω R1 resistor, the LTC6900 is disconnected from the  $V_{IO}$  supply.

To use the LTC6900 oscillator for evaluation, confirm the  $V_{IO}$  supply is properly configured, insert the JP4 jumper in Position B. This setting connects the clock oscillator's output to the ADM2895E/ADM2895E-1 TxD input pin.

Jumper JP7 allows selection of the oscillator frequency to either the preconfigured 100kHz (Position B) or 10MHz (Position A) when jumper JP8 is present. Removing jumper JP8 reduces the frequencies by 10x.

Other frequencies are possible by setting JP1 to Position C and populating an 0603 resistor in R13. The oscillator frequency may be calculated using the following frequency where R13 is in ohms:

$$F_{OSC} = 10\text{MHz} \frac{20\text{k}}{N \times R_{13}} \quad (1)$$

where  $N = 1, 10$ .

The value of  $N$  is controlled with the JP8 link. Insert the JP8 link to set  $N = 1$  for higher frequency operation and remove the link to set  $N = 10$  for lower frequency operation. The EVAL-ADM2895EEBZ ships with the JP8 link populated,  $N = 1$ .

### ADP7104 LDO REGULATOR

The EVAL-ADM2895EEBZ features an on-board [ADP7104](#) LDO regulator, which allows flexible power supply configurations during evaluation.

The  $V_{CC}$  regulator, U2, is powered from the VREG\_IN terminal on connector P1 and is configured using the JP1 jumper. This jumper position selects the regulator output to the  $V_{CC}$  pin. Options of 3.3V or 5V are available. To bypass the  $V_{CC}$  ADP7104 regulator, U2, and power the  $V_{CC}$  pin directly from the VREG\_IN terminal, insert the JP1 jumper to Position C.

**Table 3** shows the supported power supply configurations and the associated jumper configurations.

**Table 3. Primary Side Input Supply Configurations**

VREG_IN Input Voltage		
Jumper JP1	Range	$V_{CC}$ Supply
A	5.4V to 20V	Regulator provides 5V.
B	3.7V to 20V	Regulator provides 3.3V.
C	1.7V to 5.5V	Supplied directly from the VREG_IN terminal on P5.

## GETTING STARTED

### HALF-DUPLEX RS-485 LOOPBACK TEST

The [ADM2895E/ADM2895E-1](#) is a half-duplex RS-485 transceiver, which means that the bus pins for the transmitter and receiver are connected together. In a half-duplex device, when both the driver and receiver are enabled, data applied to the TxD input pin of the ADM2895E/ADM2895E-1 is transmitted by driver and is then received on the RxD output pin of the ADM2895E/ADM2895E-1. This loopback configuration can be used to evaluate both the transmitter and receiver of the ADM2895E/ADM2895E-1 on the EVAL-ADM2895EEBZ.

The details of this loopback test are shown in [Figure 2](#). The internal oscillator is connected to the TxD pin by the jumper JP4 being in Position B. Jumpers JP7 and JP8 set the oscillator frequency to 100kHz, which corresponds to a 200kbps effective bit rate. This allows the verification of the bus signals and the receiver output when the driver and receiver are enabled. The receiver is enabled when JP2 is Position C and the driver is enabled when JP3 is Position A. The JP6 jumper can be inserted to terminate the transmitter and receiver with a  $60.4\Omega$  resistor. For the jumper configurations for different power supply configurations, see [Table 3](#).

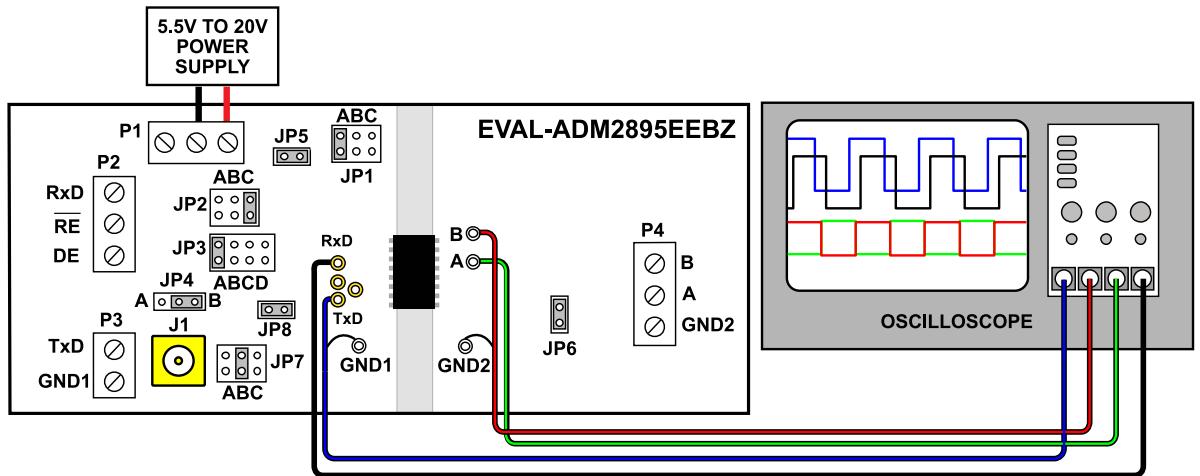
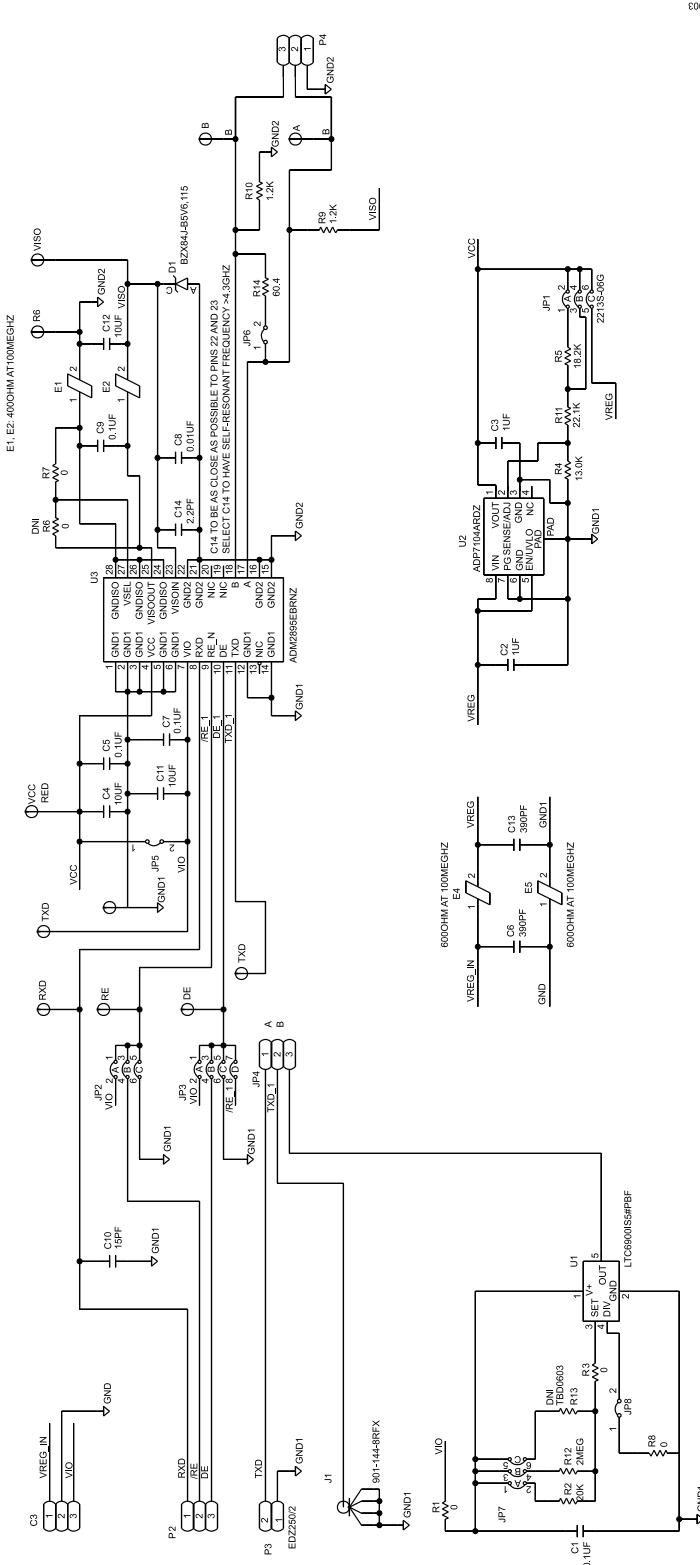


Figure 2. Half-Duplex RS-485 Loopback Test

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## EVALUATION BOARD SCHEMATIC AND SILKSCREENS



**Figure 3. EVAL-ADM2895EEBZ Evaluation Board Schematic**

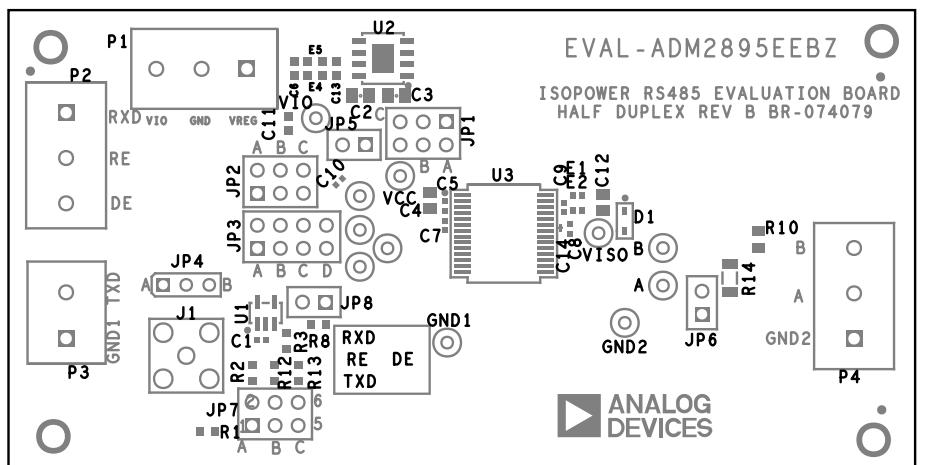
**EVALUATION BOARD SCHEMATIC AND SILKSCREENS**

Figure 4. EVAL-ADM2895EEBZ Top Silkscreen

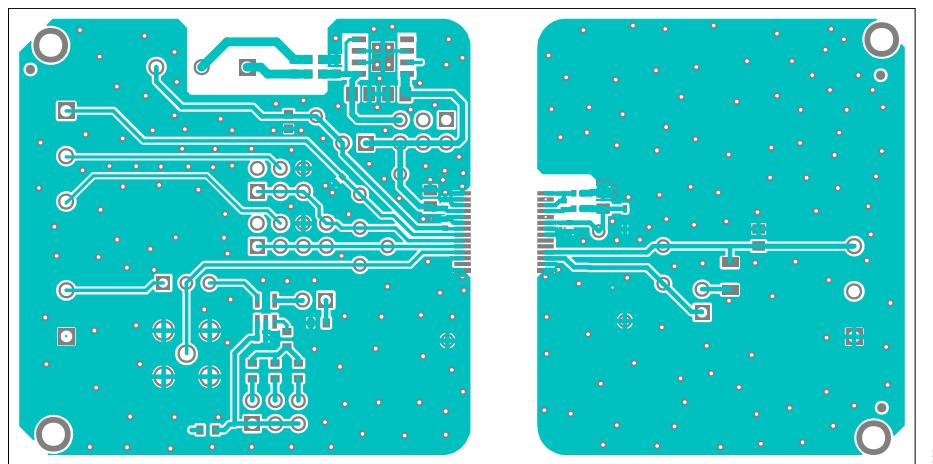
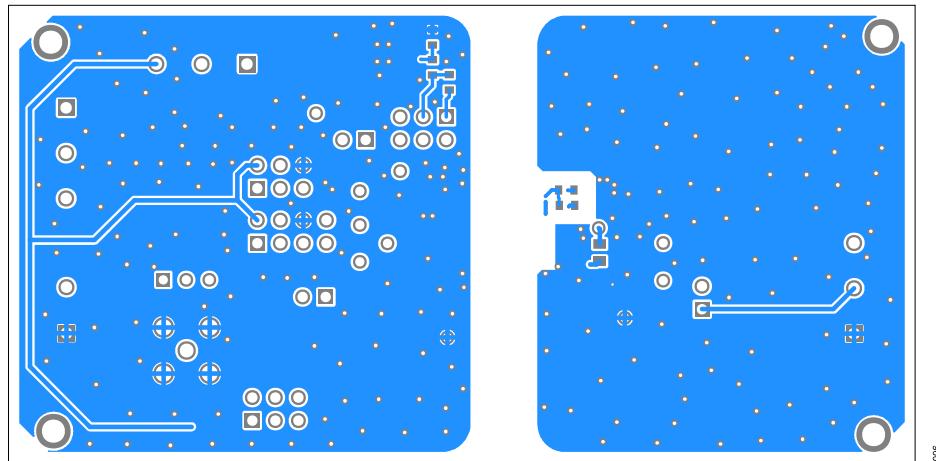
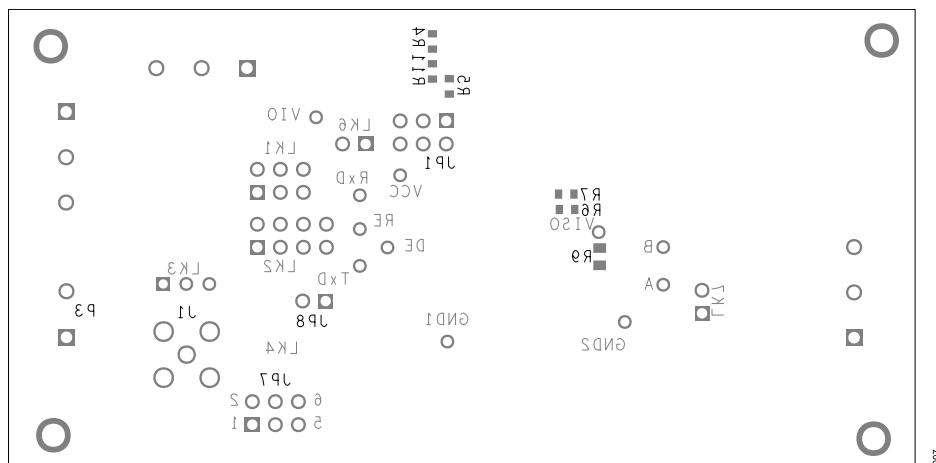


Figure 5. EVAL-ADM2895EEBZ Top Copper

## EVALUATION BOARD SCHEMATIC AND SILKSCREENS



**Figure 6. EVAL-ADM2895EEBZ Bottom Copper**



**Figure 7. EVAL-ADM2895EEBZ Bottom Silkscreen**

## ORDERING INFORMATION

## BILL OF MATERIALS

Table 4. Bill of Materials for EVAL-ADM2895EEBZ

Quantity	Reference Designator	Description	Manufacturer	Part Number
6	A, B, DE, RE, RXD, TXD	Connectors, PCB test point yellow	Keystone Electronics	5004
4	C1, C5, C7, C9	Ceramic capacitors, 0.1µF, 16V, 10%, X7R, 0402	Kemet	C0402C104K4RACTU
1	C10	Ceramic capacitor, 15pF, 50V, 1%, C0G, 0402, AEC-Q200	Murata	GCM1555C1H150FA16D
1	C11	Ceramic capacitor, 10µF, 10V, 20%, X5R, 0603, low ESR	TDK	C1608X5R1A106M080AC
2	C4, C12	Ceramic capacitors, 10µF, 25V, 10%, X5R, 0805, low ESR	TDK	C2012X5R1E106K085AC
2	C6, C13	Ceramic capacitors, 390pF, 16V, 10%, X7R, 0603	AVX Corporation	0603YC391KAT2A
1	C14	Silicon capacitor, 2.2pF, 25V, 0.1pF, 0201, AEC-Q200	AVX Corporation	02013J2R2BBSTR
2	C2, C3	Ceramic capacitors, 1µF, 25V, 10%, X7R, 0805, AEC-Q200	Murata	GCM21BR71E105KA56L
1	C8	Ceramic capacitor, 0.01µF, 50V, 10%, X7R, 0402, AEC-Q200	Murata	GCM155R71H103KA55D
1	D1	Single Zener diode, 0.55W, 5.6V, 2%, SOD-323F, AEC-Q101	Nexperia	BZX84J-B5V6,115
2	E1, E2	Inductive ferrite beads, 2.2Ω maximum DC resistance, 0.2A	Murata	BLM15HD182SN1D
2	E4, E5	Inductive ferrite beads, 0.25Ω maximum DC resistance, 0.8A	Murata	BLM18HE601SN1D
2	GND1, GND2	Connectors, PCB test point black	Components Corporation	TP-105-01-00
1	J1	Connector-PCB, SMA, jack, female socket	Amphenol	901-144-8RFX
3	JP1, JP2, JP7	Connectors-PCB, header, 2 row, vertical, 6 way, 3X M000385	Multicomp Company	2213S-06G
1	JP3	Connector-PCB, header, 2 row, vertical, 8 way, 4X M000385	Multicomp Company	2213S-08G
1	JP4	Connector-PCB, header, 3-positions	Molex	22-28-4033
3	JP5, JP6, JP8	Connectors-PCB, header, 1 row, 2 way	Harwin	M20-9990246
3	P1, P2, P4	Connectors-PCB, terminal blocks, 5.0mm pitch, 16 to 26 AWG	Wurth Elektronik	691213710003
1	P3	Connector-PCB, terminal block, 2-positions, 5.08mm pitch, 3.5mm solder tail	On Shore Technology	EDZ250/2
4	R1, R3, R7, R8	Resistors, SMD, 0Ω, 0603, AEC-Q200	Vishay	CRCW0603000ZRT1
2	R9, R10	Resistors, SMD, 1.2kΩ, 0.1%, 1/8W, 0805	Panasonic	ERA-6YEB122V
1	R11	Resistor, SMD, 22.1kΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic	ERJ-3EKF2212V
1	R12	Resistor, SMD, 2MΩ, 1%, 1/10W, 0603	Yageo	RC0603FR-072ML
1	R14	Resistor, SMD, 60.4Ω, 1%, 1/4W, 1206, AEC-Q200	Panasonic	ERJ-8ENF60R4V
1	R2	Resistor, SMD, 20kΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic	ERJ-3EKF2002V
1	R4	Resistor, SMD, 13.0kΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic	ERJ-3EKF1302V
1	R5	Resistor, SMD, 18.2kΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic	ERJ-3EKF1822V
1	U1	IC, low power, 1kHz to 20MHz resistor set SOT-23 oscillator	Analog Devices, Inc.	LTC6900IS5#PBF
1	U2	IC, 20V, 500mA, low noise, CMOS LDO	Analog Devices, Inc.	ADP7104ARDZ-R7
1	U3	5.7kV <sub>RMS</sub> signal and power isolated half-duplex RS-485 transceiver with fault protection	Analog Devices, Inc.	ADM2895EBRNZ
3	VCC, VIO, VISO	Connectors, PCB test point red	Components Corporation	TP-105-01-02

## ORDERING INFORMATION

## NOTES



### ESD Caution

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

### Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed. All Analog Devices products contained herein are subject to release and availability.

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